The European Science Foundation (ESF) Network SEDIFLUX – an introduction and overview

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Abstract

Climate change will cause major changes in the Earth surface systems, especially in high-latitude and high-altitude cold environments. Geomorphological processes operating at the Earth`s surface, transfering sediments and changing landforms are dependent on climate and will be significantly affected by climate change. More reliable modelling of sediment transfer processes operating under present-day climatic settings is needed to determine the consequences of climate change. It is necessary to collect and to compare data and knowledge from a wide range of different high-latitude and high-altitude cold environments and to develop more standardized methods and approaches for future research on sediment fluxes and relationships between climate and sedimentary transfer processes. In Europe the wide

range of high-latitude and high-altitude cold environments provides great potential to investigate climate-process relationships and to model the effects of climate change by using space for time substitution. The European Science Foundation (ESF) Network (01.01.2004 - 31.12.2006) *"Sedimentary Source-to-Sink-Fluxes in Cold Environments" (SEDIFLUX)* is bringing together leading scientists, young scientists and research teams from different fields. SEDIFLUX forms a framework for an integrated and multidisciplinary investigation of the addressed topic and is a major catalyst for strengthening and extending contacts, collaborative research activities and mobility of scientists in Europe. It also points to areas within Europe that would benefit from wider research collaboration (e.g. Russia, Poland). The SEDIFLUX Steering Committee consists of scientists from seven European countries: ACHIM A. BEYLICH, Co-ordinator of SEDIFLUX (Trondheim, Norway), SAMUEL ETIENNE (Clermont-Ferrand, France), BERND ETZELMÜLLER (Oslo, Norway), VYACHESLAV V. GORDEEV (Moscow, Russia), JUKKA KÄYHKÖ (Turku, Finland), VOLKER RACHOLD (Potsdam, Germany), ANDREW J. RUSSELL (Newcastle, England, UK), KARL-HEINZ SCHMIDT (Halle/S., Germany), ÞORSTEINN SÆMUNDSSON (Sauðárkrókur, Iceland), FIONA S. TWEED (Staffordshire, England, UK) and JEFF WARBURTON (Durham, England, UK). SEDIFLUX activities include four Science Meetings in Sauðárkrókur, Iceland (June 18th – June 21st, 2004), Clermont-Ferrand, France (January 20th – 22nd, 2005), Durham, England, UK (December 2005) and Trondheim, Norway (October 2006), Steering Committee Meetings attached to these Science Meetings, a Session co-organized by SEDIFLUX at the Second European Permafrost Conference, June 12th – 16th, 2005, in Potsdam, Germany, publication of Scientific Reports and Abstract Volumes, publication of Special Issues of Journals and of a SEDIFLUX Handbook, creation of a SEDIFLUX Database, an effective diffusion and dissemination of SEDIFLUX activities and outputs by using electronic media (Web-sites, Newsletters, Forum), invitations of leading experts from other parts of the world, policy makers and land managers to the Science Meetings. The ESF Network SEDIFLUX is organized in four Working Groups: I Selection of critical test catchments, II Analysis of geographical and geological settings of test catchments, III Analysis of present-day fluxes, IV Integration and data management. The major outputs from the Working Groups will be published in the SEDIFLUX Handbook, including guidelines for future monitoring programmes and a section, which is particularly targeted at end-users. A strong monitoring and operational data collection and more standardized methods provides a baseline for the development of reliable models and for future research in the changing high-latitude and high-altitude cold environments. ESF SEDIFLUX is planned to continue and to be extended as IAG Working Group on Sediment Budgets in Cold

Environments (SEDIBUD). Apart from further collaborations and collaborative research activities project and programme applications at both the national and the European level following the three-year ESF Network are discussed and initiated.

1 *Scientific background*

Climate change will cause major changes in Earth surface systems and the most dramatic changes are expected to occur in the high-latitude and high-altitude cold environments of the Earth. These cold climate landscapes are some of the last wilderness areas containing specialized and diverse plants and animals as well as large stores of soil carbon. Geomorphological processes, operating at the Earth`s surface, transfering sediments and changing landforms are highly dependent on climate, vegetation cover and human impacts and will be significantly affected by climate change. In this context it is a major challenge to develop a better understanding of the complex ecosystems and the mechanisms and climatic controls of sedimentary transfer processes in cold environments. A better knowledge and a more reliable modelling of sedimentary transfer processes operating in present climates at the Earth`s surface is needed to determine the consequences of predicted climate change. It is necessary to collect and to compare data and knowledge from a wide range of different high latitude and high altitude environments and to apply more standardized methods and approaches for future research on sediment fluxes and relationships between climate and sedimentary transfer processes. Geomorphological studies of the impacts of change over contemporary and historic timescales can make an important contribution to debates about wider issues of resource management in high latitude and high altitude environments. The Network`s output benefits local communities, larger organisations like conservation, forest, hydro-power and tourist industries, international organisations (regional and global organisations seeking to assess, monitor and remotely sense environmental changes) and the scientific community. There is a great diversity in the intensity of human impact on the different high-latitude and high-altitude environments in Europe. SEDIFLUX identifies the main human drivers of changes at the investigated sites, the indicators of social and environmental change, and undertakes a risk assessment. The highly relevant issues to be addressed need a multidisciplinary approach and the joining of forces and expertise from different scientific fields. A strongly increased exchange between scientists and research teams within the European scientific community is essential; researchers may be working on the same topic but have different scientific backgrounds. The unification and linking of

methods and approaches as one major topic of discussion within the ESF Network *"Sedimentary Source-to-Sink-Fluxes in Cold Environments" (SEDIFLUX)* is necessary to achieve a comparability of data and knowledge from monitoring campaigns from different environments. A strong monitoring and operational data collection – including the analysis of extreme events - provides a baseline for the development of reliable models and for future research in the changing cold environments. In Europe the wide range of cold environments at high latitudes and high altitudes – from high arctic and subarctic environments to alpine and upland environments - provides an ideal opportunity to investigate relationships between climate and sedimentary transfer processes and to model effects of climate change by using space-for-time substitution.

Quantitative investigations on sediment transfers in cold environments are still rare compared with the amount of such research in other climatic zones. An integrated study of source-to-sink sediment fluxes in cold environments includes the analysis of the processes of weathering, chemical denudation, erosion, mass movements, fluvial transfers/transportation and sedimentation in lakes and coastal areas. The combination of the different components of weathering, mass transfers and sedimentation requires collaboration of specialists working on these special topics. In spite of existing studies on single components, there is clear lack of integrated approaches joining the different topics and linking the different methods and approaches applied.

2 *The need for a Network*

SEDIFLUX brings together leading scientists, young scientists and research teams from different fields from a wide range of European countries, North America (observer), Japan (observer), New Zealand (observer), and South Africa (observer). It forms a strong framework for an integrated and multidisciplinary view on *"Sedimentary Source-to-Sink Fluxes in Cold Environments"*. Until today, no such European Network and no larger collaborative research programmes exist on this relevant topic. Several research teams have collaborations within Europe and also with scientists from Japan, North America, South Africa etc. but a larger framework for more intensive and more effective collaboration at the European level is completely missing. SEDIFLUX provides an opportunity to strengthen the already existing contacts and to build up new collaborations between scientists and research teams in Europe, including significant links to other parts of the world. Apart from leading scientists it also gives young scientists the possibility to present, discuss and exchange scientific results, to

develop and strengthen a broad network of scientific contacts and to increase their mobility within Europe. In this way is SEDIFLUX also in the longer run a major catalyst for scientific exchange and collaboration in Europe. A major strength of the Network is that it brings together scientists from different scientific fields. Physical Geographers, Quaternary Geologists, Geologists, Oceanologists, Limnologists, Global Change researchers, Meteorologists Civil Engineers, Paleobiologist, Ecologists and Biologists are discussing and exchanging scientific results and knowledge and develop the addressed Network topics in an effective way by bringing in different scientific backgrounds, expertise, methods and approaches. The Network is highly related to the progressively relevant problems connected to "Climate Change". It provides contributions by focusing on and modelling relationships between climate and geomorphological processes in a wide range of environments at high latitudes and altitudes. By using the ergodic principle of space-for-time substitution it is possible to model effects of climate change on the investigated Earth surface processes. The range of knowledge of different environments, all of which have experienced different climate regimes and different recovery rates from glaciation, can be related to change over time. In this way SEDIFLUX points to problems of high relevance for the European Community and will – also in the longer run – serve as framework and basis for joining forces to find solutions for these problems.

SEDIFLUX activities include four Science Meetings, Steering Committee Meetings attached to these Science Meetings, a Session co-organized by SEDIFLUX at the Second European Permafrost Conference, June 12th – 16th, 2005, in Potsdam, Germany, and an effective diffusion and dissemination of Network activities and outputs. Science Meetings are organized in four different countries in Sauðárkrókur, Iceland (June 18th – 21st, 2004), Clermont-Ferrand, France (January 20th – 22nd, 2005), Durham, England, UK (December 15th-19th, 2005) and Trondheim, Norway (October 2006). All SEDIFLUX members are invited to these Science Meetings to present and discuss the latest scientific results from different high-latitude and high-altitude cold environments. Other scientists are also welcome to participate. In addition to scientific exchanges, the Science Meetings are also an excellent possibility to build up new contacts and to discuss new collaborations and collaborative research activities. In this way the Science Meetings form a major catalyst to build up a broad and effective network of contacts between leading scientists and young scientists from different fields working on the same scientific questions. Talks and posters are presented to all Science Meeting participants. Abstract Volumes and Scientific Reports are published and the major scientific contributions at the Science Meetings are published in Special Issues of relevant

scientific journals. Additionally, there are intensive discussions and more detailed exchanges in four Working Groups: I Selection of critical test catchments, II Analysis of geographical and geological settings of test catchments, III Analysis of present-day fluxes, IV: Integration and data management. The main purpose of these Working Groups is to create a SEDIFLUX Database, to discuss methods and the unification of techniques, and to apply more standardized approaches to achieve a better comparability of data and knowledge from different environments. At the end of the Network period – after four meetings of the different Working Groups - each Working Group is invited to present summarizing contributions and guidelines for future investigations and monitoring programmes in selected test catchments, which will be published in a SEDIFLUX Handbook. This Handbook will also contain a section which is particularly targeted at “end-users” like policy makers, land managers etc., who are also invited to the workshops. It will serve as a guide for a larger multinational and longer running monitoring programme which will follow the three-year ESF Network.

Information on Science Meetings, Steering Committee Meetings and other SEDIFLUX activities is disseminated by electronic media. A Website for each Science Meeting, containing all necessary information on organisation, programme, keynote speakers and participants, is established by the Science Meeting organizers. The Network Co-ordinator sends around an electronic SEDIFLUX Newsletter two to three times each year to all SEDIFLUX members and linked groups, organisations, projects and programmes. A continuously up-dated central SEDIFLUX Web-site with detailed information on the Network, its background, aims, SEDIFLUX Database, Steering Committee, SEDIFLUX Members, SEDIFLUX activities, news/current status and major outputs is established by the Network Co-ordinator with support from the other Steering Committee members.

SEDIFLUX forms a basis for the development of further and longer running collaboration at the European level. All Steering Committee members have a strong interest in further collaboration and collaborative research activities following the three-year ESF Network. The interests are mainly focused on the topics “Sediment fluxes”, “Sediment budgets”, “Source-to-sink fluxes/correlations” and – connected to that – “Climate Change”. ESF SEDIFLUX is planned to continue and to be extended as IAG Working Group on "Sediment Budgets in Cold Environments" (SEDIBUD). Apart from the extension of contacts and collaboration project and programme applications at both the national and the European level are discussed and initiated (for example multinational, longer running monitoring campaigns with process measurements in different high-latitude and high-altitude cold environments).

3 *Diffusion and dissemination*

Diffusion and dissemination are undertaken by using electronic media, inviting leading experts from other parts of the world to the SEDIFLUX Science Meetings, by the publication of Abstract Volumes and Scientific Reports on the Science Meetings, by significant Journal Publications (Special Issues) and by the Publication of a SEDIFLUX Handbook. Websites for the four Science Meetings and a central, continually up-dated SEDIFLUX Website are established. A SEDIFLUX Newsletter is sent electronically two to three times each year to all SEDIFLUX members and linked groups, organzations, programmes and projects by the Network Co-ordinator. The SEDIFLUX Newsletter contains information on the different Working Groups, reports, outputs, news/current status, further SEDIFLUX activities and plans etc. A discussion forum is established which creates a permanent link between members of the Network and extends discussions of the Science Meetings. All SEDIFLUX members are invited to send contributions for the SEDIFLUX Newsletter, informing on relevant activities and plans of related groups, organizations, working groups, research teams and programmes etc.. In this way also a close contact and dissemination to national geomorphology groups (British Geomorphological Research Group (BGRG) and related Working Groups, German Working Group of Geomorphologists (DAK Geomorphologie), French Group of Geomorphology (GFG), etc.) will be possible. Dissemination of information to policy makers and land managers in the EC is through the SEDIFLUX Newsletter and special invitations to the Science Meetings.

By inviting two key researchers/keynote speakers from other parts of the world (e.g. North America, Japan, New Zealand) to each Science Meeting diffusion and dissemination of SEDIFLUX activities and scientific outputs to other parts of the world are strengthened. Relevant and accepted scientific contributions from the four Science Meetings in Sauðárkrókur, Clermont-Ferrand, Durham and Trondheim are/will be published in Special Issues of leading journals. The SEDIFLUX Handbook with contributions from all Working Groups will summarize the main scientific outputs of the ESF Network including guidelines for future research (see above). The SEDIFLUX Handbook will also contain recommendations for future actions, based on experiences gained during the Network period. One section of the Handbook will be particularly targeted at “end-users” like policy makers and land managers. The development of a guide is also planned for the uniform and standardized instrumentation of different high-latitude and high-altitude cold environments

(meteorological stations, geomorphological process monitoring). The data from these longer term monitoring sites (multinational and multidisciplinary projects, programmes following the three-year ESF Network) would be comparable and could be used for space for time substitution and more reliable models.

For more information on SEDIFLUX see: http://www.ngu.no/landskap and http://www.esf.org/sediflux and contact the SEDIFLUX Co-ordinator: Achim.Beylich@ngu.no.

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